

REMARKS

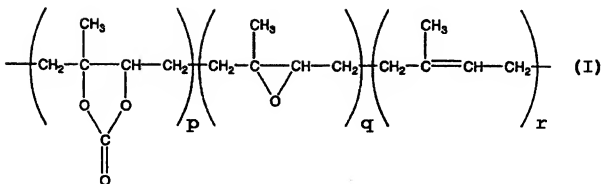
I. Status of Claims

Applicant has amended claim 1 to change the transitional phase “consisting essentially of” to “consisting of.” Applicant has added new claim 9. Written support for new claim 9 can be found in the as-filed specification, e.g., at page 9, lines 13-22. No new matter has been introduced. Claims 1-9 are currently pending.

II. §§ 102(b)/103(a) rejection of claim 1 over SU ‘262

Applicant respectfully requests reconsideration and withdrawal of the rejection of claim 1 under 35 U.S.C. § 102(b) or §103(a) over SU 422262 (“SU ‘262”).

Regarding claim 1, the Office Action asserted that claim 1 does not limit the claimed polymeric compound to the structure represented by formula (I). Office Action, page 4. The Office Action also asserted that “applicant intends that some extra units are permissible” in claim 1. *Id.* Applicant respectfully points out that because claim 1 recites that the sum of molar composition ratios p, q, and r is 1, it excludes any other monomer units not included in formula (I). Accordingly, claim 1 limits the claimed polymeric compound to the structure represented by formula (I). Nevertheless, to move the case forward, Applicant has amended claim 1 to recite, “[a] cyclic carbonate-containing polymeric compound consisting of a polymeric compound represented by formula (I):



wherein . . . the sum of p, q, and r is 1."

Amended claim 1 limits the scope of the compound to consist of the structure expressly depicted in formula (I). Any other monomer units that are not included in the formula (I) are excluded from the claim. See M.P.E.P. §2111.03. SU '262 fails to disclose or suggest the compound expressly depicted in formula (I).

In response to Applicant's argument that Example 2 of SU '262 would not necessarily result in the claimed compound, the Office Action maintained the position that SU '262 "performs the same reaction as applicant and therefore would exhibit the same final structure." Office Action, page 2.

Applicant respectfully submits that SU '262 1) fails to disclose all of the features of the claimed method, and 2) does not perform the same reaction as the claimed method. Specifically, SU '262 is silent with regard to "deproteinizing natural rubber" and "epoxidizing the deproteinized natural rubber," as recited in method claim 2. SU '262 instead discloses using epoxidized polydienes or polyisoprenes as starting products. See page 1, lines 19-20; page 2, lines 15-16; page 3, line 15. Further, neither of the above-quoted steps is one of the results or characteristics necessarily present in SU '262, which merely teaches using epoxidized polydienes or polyisoprenes as

starting products. See M.P.E.P. § 2112 (IV) (to establish inherency, the extrinsic evidence must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill). In this case, it is at most a mere possibility to use the above-quoted steps to prepare the starting material, epoxidized polyisoprenes, used in the method of SU '262. *Id.* (Inherency may not be established by probabilities or possibilities). The Office Action therefore fails to establish anticipation of claim 1 over SU '262 based on inherency.

With regard to the alleged obviousness of claim 1 under § 103(a), Applicant points out that SU '262 fails to teach or suggest deproteinization of natural rubber, which should be used as a starting material to arrive at the cyclic carbonated polymeric compound, as claimed. See also Reply to Office Action filed February 4, 2010, pages 5-7. SU '262 also neither teaches nor suggests any benefits of using natural rubber in its reaction. One of ordinary skill in the art, therefore, would not have had any legitimate reason to add the above-quoted "deproteinizing natural rubber" and "epoxidizing the deproteinized natural rubber" to the method disclosed in SU '262 to arrive at the claimed method. Accordingly, contrary to the Office's position, SU '262 neither discloses nor suggests performing the same reaction as the claimed method, thereby failing to produce the claimed cyclic carbonated polymeric compound, as recited in claim 1.

For at least the foregoing reasons, the § 102(b)/103(a) rejection of claim 1 based on SU '262 should be withdrawn.

III. § 103(a) Rejections of Claims 1-8

Applicant respectfully requests reconsideration and withdrawal of the rejection of claims 1-8 under 35 U.S.C. § 103(a) over SU '262 in view of JP 2002053573 ("JP '573"), and further in view of U.S. Patent No. 6,204,358 to Tanaka et al. ("Tanaka"); and the rejection of claims 1-8 under § 103(a) over SU '262 in view of Kawanami et al., *Research of carbonate synthesis using supercritical carbon dioxide and ionic liquid*, abstract, the 35th Fall Meeting of Society of Chemical Engineers, Japan, September 18-20, 2002 ("Kawanami"), and further in view of Tanaka for at least the following reasons.

A. Claim 1 is neither disclosed nor suggested by the cited references

As discussed above, amended claim 1 limits the scope of the compound to consist of the structure expressly depicted in formula (I), which is neither disclosed nor suggested by SU '262, JP '573, Tanaka, or Kawanami.

B. Office Action's assertion on natural rubber composition

The Office Action also relied on the combination of the cited references and asserted the obviousness of method claim 2 for producing the cyclic carbonate-containing polymeric compound according to claim 1. Specifically, regarding the starting material, natural rubber, the Office Action asserted that Komuro et al., *Treatise of Technologies for Processing Synthetic Rubbers, Isoprene Rubbers*, Vol. 1 (1975) ("Komuro"), cited in the February 4, 2010 Reply, and Dictionary of Rubber cited in the Advisory Action purportedly show that natural rubber also has 3, 4 isoprene units. Office Action, page 4.

Applicant notes that Dictionary of Rubber is dated March 7, 1975, on its face, indicating that the publication date is no later than March 7, 1975. Applicant also notes

that the publication date of Komuro is also August 10, 1975. See the "copyright page" of Komuro. Furthermore, Applicant points out that Komuro was cited in the February 4, 2010 Reply at page 7 for its disclosure of structures of isoprene units in Table 2-1, not for any disclosure of natural rubber composition in Table 2-2.

For the purpose of showing the latest knowledge of natural rubber composition, according to Applicant's information and belief, Applicant's February 4, 2010 Reply included a copy of S. Amnuaypornsi et al., *Green Strength of Natural Rubber: The Origin of the Stress-Strain Behavior of Natural Rubber*, Journal of Applied Polymer Science, Vol. 111, pp. 2127-2133 (2009) ("Amnuaypornsi"). As explained on pages 6-7 of the February 4, 2010 Reply, Amnuaypornsi discloses that natural rubber contains 100% cis-1,4 isoprene units and does not contain 3,4-units. See Amnuaypornsi, page 2131, right column, 2nd paragraph.

In view of the above disclosures, Applicant respectfully requests withdrawal of the Office Action's position that natural rubber has 3,4 units, and submits that the claimed compound would require, as a starting material, natural rubber containing no amount of 3, 4 units.

C. Unexpected advantages from "deproteinizing natural rubber" in claim 2

In the August 12, 2009 Reply, Applicant cited the following documents: Kihara et al., J. Org. Chem. Vol. 58, pp. 6198-6202 (1998) ("Kihara"); Klinklai et al., Solid State Ionics, Vol. 168, pp. 131-136 (2004) ("Klinklai"); and Kawahara et al., J. Polym. Sci. Part A: Polym. Chem., Vol. 44, pp. 1561-1567 (2006)¹ ("Kawahara"). Klinklai and

¹ In the August 12, 2009 Reply, the publication year of Kawahara was incorrectly noted as "2005." Applicant respectfully submits that the correct publication date of Kawahara is January 12, 2006, as evidenced by the relevant information submitted herewith.

Kawahara were published on March 15, 2004, and January 12, 2006, respectively², subsequent to the foreign priority date of the present application, March 1, 2004.³ Kihara was published in 1998, prior to the priority date of the present application.

In view of the teachings of the above documents, the August 12, 2009 Reply, pages 6-8, pointed out that deproteinization of natural rubber prior to the epoxidation step is necessary to produce the claimed cyclic carbonated polymeric compound. In short, Klinklai teaches that it is impossible for epoxy groups contained in an epoxidized natural rubber to interact with a catalyst (a Li salt) unless the natural rubber has been deproteinized, since water associated with proteins interacts with the epoxy groups. See Klinklai, page 132, col. 1, lines 1-6; page 132, col. 1, lines 3-14; page 135, col. 1, line 26- col. 2, line 15. Kawahara also discloses that the cyclic carbonated natural rubber would not be produced when a natural rubber containing proteins is used as a starting material without being deproteinized. See Kawahara, e.g., page 1561, col. 1, lines 20-26.

Kihara, as well as the references cited in the Office Action, neither discloses nor suggests these advantages of employing "deproteinizing natural rubber" prior to epoxidation. The Office Action cited Tanaka for its alleged disclosure of "removal of non-rubber components from such natural rubber." Office Action, pages 2-3. Tanaka, however, does not recognize that a cyclic carbonated polymeric compound cannot be prepared unless natural rubber is deproteinized prior to an epoxidation step. Because the advantages of deproteinizing natural rubber prior to epoxidation in the method for producing the cyclic carbonate-containing polymeric compound compound were not

² See the attached information regarding the publication dates of these documents.

³ The priority date, March 1, 2004, was perfected by submitting the certified English language translation of the foreign priority document, JP 2004-056275, with the August 12, 2009 Reply.

known in the art at the time of invention, they should not be considered as mere recognition of additional advantages or latent properties present in the prior art.

For at least these reasons, the method for producing the cyclic carbonate-containing polymeric compound according to claim 1, as set forth in claim 2, is not obvious over the cited references. See M.P.E.P. § 2141.02 (obviousness cannot be predicated on what is not known at the time an invention is made, even if the inherency of a certain feature is later established).

Since none of these references, alone or in combination, discloses or suggest the compound expressly recited in amended claim 1, or the method as recited in claim 2, claims 1-8 are allowable over the cited references.

IV. New Claim 9

Since new claim 9 depends from claim 1 via intervening method claim 2, the claim is allowable for at least the same reasons as set forth above for amended claim 1.

In addition, new claim 9 recites, "liquefying the deproteinized natural rubber or the epoxidized deproteinized natural rubber via depolymerization," which is neither disclosed nor suggested by the cited references, viewed alone or in combination. For this additional reason, new claim 9 is allowable.

In view of the foregoing amendments and remarks, Applicant respectfully requests reconsideration of this application, withdrawal of the rejections, and timely allowance of the pending claims.

Please grant any extensions of time required to enter this response and charge any additional required fees to our deposit account 06-0916.

Respectfully submitted,
FINNEGAN, HENDERSON, FARABOW,
GARRETT & DUNNER, L.L.P.

Dated: June 22, 2010

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Attachments: copies of webpages disclosing the publication dates of Klinklai et al., Solid State Ionics, Vol. 168, pp. 131-136 (2004); and Kawahara et al., J. Polym. Sci. Part A: Polym. Chem., Vol. 44, pp. 1561-1567 (2006).



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Ionic conductivity of highly deproteinized natural rubber having epoxy group mixed with alkali metal salts

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Abstract

The ionic conductivity of highly deproteinized liquid natural rubber having epoxy group (LEDPNR) mixed with alkali metal salts was investigated through impedance analysis to clarify the effect of proteins present in the rubber. The LEDPNR, thus used, was prepared from depolymerization of epoxidized natural rubber (ENR) latex, which was deproteinized by incubation of the latex with proteolytic enzyme and surfactant. The ionic conductivity of the resulting LEDPNR was dependent upon the alkali metal salts, where the ionic conductivity of LEDPNR/tetrabutylammonium trifluoromethanesulfonate (TfTfS) was higher than that of LEDPNR/titanium perchlorate (LiClO_4). The difference in the ionic conductivity was attributed to the solubility of the salts through both high-resolution solid-state ^{13}C nuclear magnetic resonance (NMR) spectroscopy and measurements of spin-lattice relaxation time. The ionic conductivity of LEDPNR/TfTfS was also dependent upon concentration of TfTfS and the conductivity reached the highest value at 20 wt.%, which was different from the monotonic increase in the ionic conductivity of liquid ENR prepared from untreated natural rubber latex.

Author Keywords Deproteinized natural rubber; Liquid epoxidized natural rubber; TfTfS; Polymer electrolyte; Ionic conductivity

Article Outline

1. Introduction
2. Experimental
- 2.1. Sample preparation
- 2.2. Measurements
3. Results and discussion
4. Conclusions
- Acknowledgements
- References

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Note

Preparation of carbonated natural rubber

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KEYWORDS

functionalization of polymers • NMR • rubber

ABSTRACT

Carbonated natural rubber was prepared from deproteinized natural rubber with supercritical carbon dioxide, in which the deproteinization of natural rubber was performed in the latex stage with urea in the presence of a surfactant. The deproteinized natural rubber was epoxidized with peracetic acid in the latex stage, and this was followed by depolymerization with peroxide to prepare liquid epoxidized natural rubber. The liquid epoxidized rubber was incubated with supercritical carbon dioxide with lithium bromide as a catalyst at various temperatures and pressures. The product was proved to be carbonated natural rubber by means of Fourier transform infrared, ^1H NMR, ^{13}C NMR, two-dimensional ^1H - ^1H correlation, two-dimensional ^1H - ^{13}C correlation, and two-dimensional heteronuclear multiple bond correlation.



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